

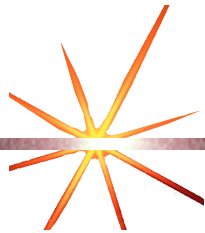
Nal(Tl) SCINTILLATION CRYSTAL SPECIFICATIONS

Physio-Chemical Properties

Chemical Name:	Sodium Iodide (Thallium Activated)
Chemical Formula:	Nal(Tl)
Type / Form:	Solid, Single Crystal
Structure	Cubic, Face Centered (FCC)
Density (g/cm ³)	3.671 (X-ray); 3.6714 (Weight-Experimental)
Molecular Weight AMU	149.849
Effective Atomic No. "Z"	50.8
Cleavage	(100)
Hardness (Mho)	2.0
Melting Point (°C)	651
Hygroscopic	Yes
Solubility in H ₂ O (g/100g @ 25°C)	184
Solubility in Alcohol (g/100g @ 25°C)	42.57
Solubility in Acetone (g/100g @ 25°C)	39.9

Radiation-Scintillation Properties

Relative light yield, PH (%) -PMT	100%*(Other scintillators are measured relative to Nal(Tl))
Photon Yield/Mev (PMT Sensor)	45,200
SCINT. Quantum Efficiency with PMT	13.5%
Photon Yield/Mev (Si-PD Sensor)	43,000
SCINT. Quantum Efficiency with PD	12.85%
Is/Id(amps)PMT Norm. to Nal(Tl)	100% *
$\Delta E/E$ -% FWHM for Dia. = Ø2.0" x 2.0" L	≤ 5.8 BEST MEASURED for 662 kev γ-rays
$\Delta E/E$ -% FWHM for Most Sizes	Typical 6.5%-8.5%
Radiation Length (cm)	2.59
Radiation Hardness To γ Ray (rad)	>1000
Linear Attenuation Coeff. (cm ⁻¹)	0.3505 (for 500 Kev)
Thickness to Attenuate 90% γ -Rays	6.5 cm
α/β Ratio Cleaved Surface	0.6-0.7
α/β Ratio (²⁴¹ Am-Tl) Doping	0.82

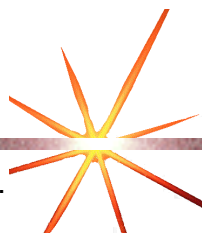


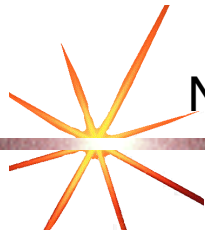
Optical Quality

Appearance	Clear, Water White
Index of Refraction @ 589.3 nm Na-D	1.7745
Index of Refraction @ 415 nm	1.85 @ λ_{MAX}
Bar-Geometry, Entrapped Light	52.4% in air surrounding
Emission Peak Wavelength (nm)	413/White
Decay Constant At Room Temp. (ns)	230/(≥ 150 ms)
Percent Intensity in Mode	91% / 9%
Risetimes-ns (10%-90%)	8
Afterglow at 6 msec (%)	0.3—0.5
Temp. Coeff. of Scint. Light	(-0.2 to -0.95)%/ $^{\circ}$ C @ 20 $^{\circ}$ C-40 $^{\circ}$ C
Thermal Coeff. Of Linear Expansion	47.4 X10 $^{-6}$ % / $^{\circ}$ C
Thermal Conductivity	83 x 10 $^{-4}$ Cal/sec cm 2 $^{\circ}$ C

Mechanical Properties

Young's Modulus 1010 N/m 2	2.02 Average Calculated from Elastic constants Flexure 2.2 Tension/Compression
Shear Modulus 109 N/m 2	7.67
Bulk Modulus 1010 N/m 2	1.8
Poisson's Ratio	0.314
Yield Strength (psi) Flexure	254-344 Single Crystal 585-900 Polycrystalline Measured
Mechanical Behavior at Room Temp.	Plastic flow considerable in Single Crystal Polycrystalline form is almost brittle





Nal(TL) CRYSTAL BLANK SPECIFICATIONS

Dimensions: Length _____ Width _____ Height _____
OR
Diameter _____ Length _____
OR For Other Geometries Attach a Drawing or Sketch

Tolerances: All dimensions $+ .25 / - .00 \text{mm}$ ($+ .010 \text{''} / - .000 \text{''}$)

Resolution: For **Dia. = $\varnothing 2.0 \text{''}$ x 2.0'' Length \leq** to 7.6% FWHM @ 662Kev for Cs137*

Appearance: Crystal blanks are to be water white with NO visual imperfections. Such imperfections typically include flock & inclusions, striae, edge cracks due to heat fractures, etc. - The crystal blank should be free from these defects.

*As measured with a catalog spec. Hamamatsu R-1306 2" PMT or equivalent

It is not necessary to measure each and every blank. A representative sample cut from the same boule or ingot-section should meet this performance criteria.

All surfaces supplied should be at minimum industry-standard scintillation polish, unless otherwise specified.

